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## (54) Modular electronic or optical assembly

(57) A modular design of electronic or opto-electronic apparatus has individual modules (10) plugging in to a back-plane structure (11) which provides interconnection between the various modules. Each module (10) is provided with a separate port (12b) dedicated to input/output, and this does not plug into the back-plane interconnection board itself, but instead plugs into an interconnection module (15) that is detachably mounted in the structure (11) holding the back-plane interconnection board. This provides additional flexibility for accommodating upgraded modules that have higher capacity input/output port requirements (e.g. co-ax or optical fibre instead of twisted pair). A port cover (22) may also support a connected module (10).

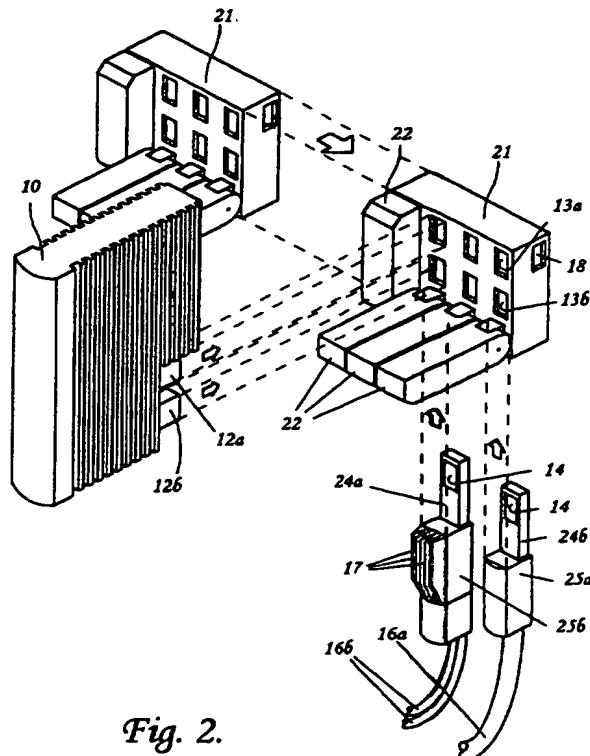


Fig. 2.

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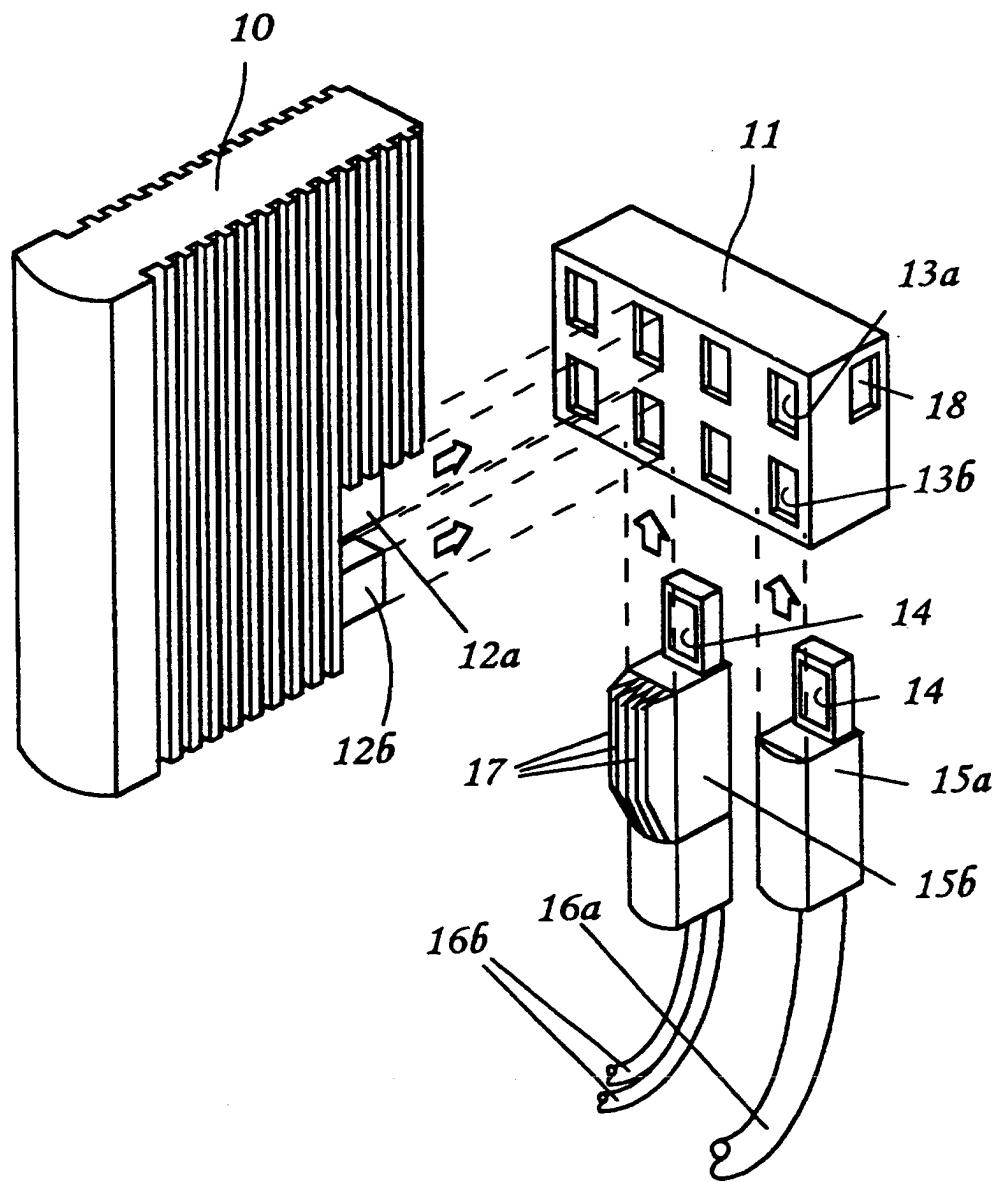


Fig. 1.

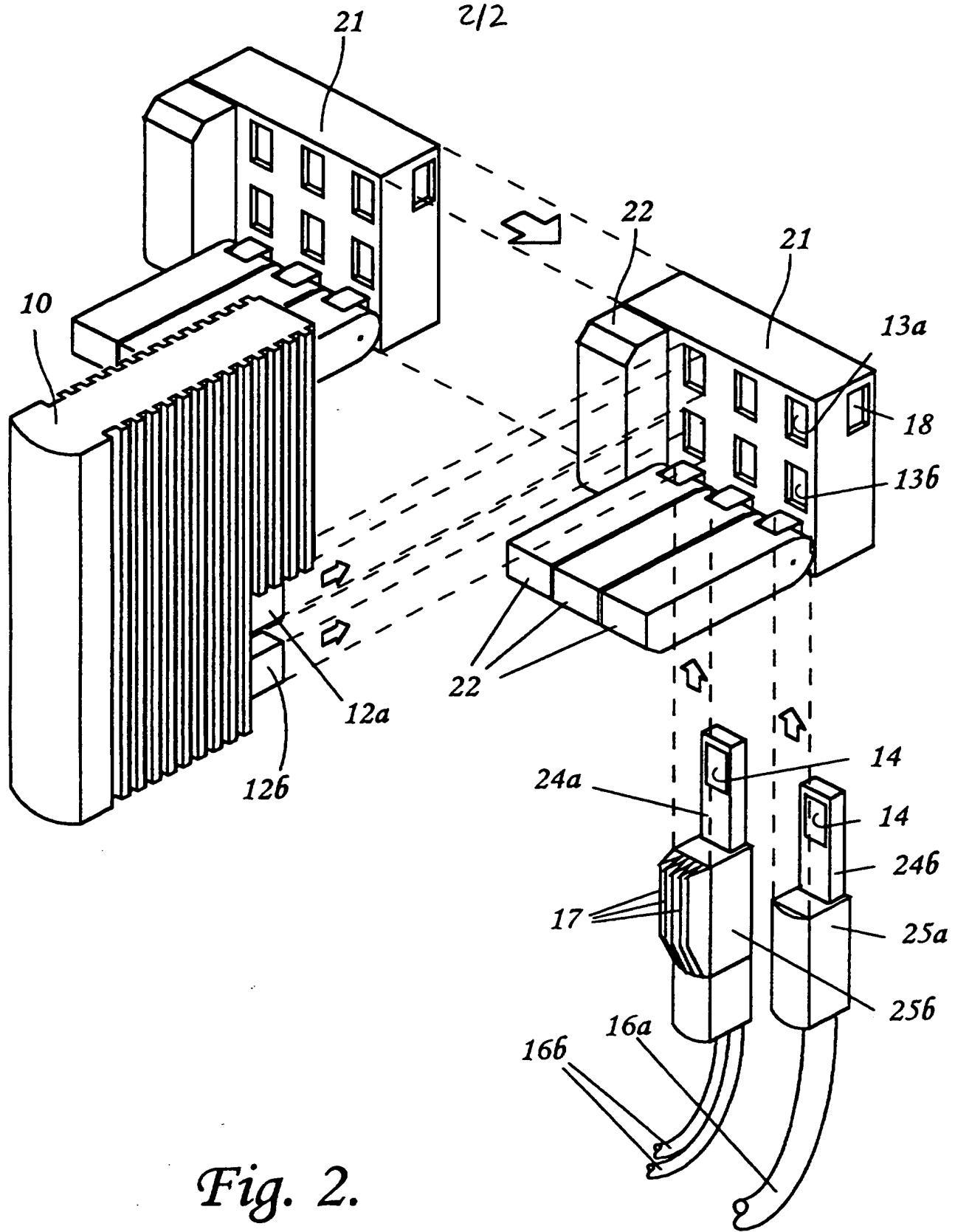


Fig. 2.

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### **EQUIPMENT PRACTICE**

- In a modular construction of electronics or opto-electronics equipment one may have a set of modules performing different functions that plug into a back-plane structure. This back-plane structure provides 5 interconnection between the different modules; it may provide a power supply for the modules; and it may also provide carded input/output connections for the different modules.
- It is desirable in certain instances to provide a back-plane structure that 10 can accept upgraded plug-in modules. This may occur for instance in a Passive Optical Network (PON), where individual Optical Network Units (ONUs) that lie between subscribers and an Optical Line Terminator (OLT) require upgrading over the life of the PON in order to enhance the facilities that it offers. For instance a PON installation may initially offer 15 only POTS (Plain Ordinary Telephone Service) to its subscribers, but later be upgraded through stages to provide Narrow-band, Broad-band, and then Video-on-demand through the medium of twisted pair, coax and optical fibre. In attempting a modular construction of such an ONU the provision of connection facilities for each of these media on the one 20 back-plane would involve a high level of component and tracking redundancy, and would also militate against compactness of design.

The present invention is directed to a modular construction in which these problems are alleviated.

- 25 According to the present invention there is provided a modular construction of electronics or opto-electronics equipment having a set of functional electronics or opto-electronics modules that plug into a back-

plane structure that provides interconnection between the modules plugged into the back-plane structure, wherein each functional module is provided with a plurality of plug-in ports for engagement with the back-plane structure, of which plurality one is dedicated to an input/output

- 5 function and at least one other provides interconnection via the back-plane structure with one or more other functional modules plugged into the back-plane structure, wherein said one plug-in port dedicated to an input/output function plugs into an associated flexible lead termination module which is releasably engaged in the back-plane structure.

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- In the life of such equipment, if there is a requirement to upgrade one or more of its functional modules in order to expand the facilities offered by the equipment, and if such an upgrade involves a change in the type of input/output connections to any of the functional modules, then, not only 15 is the functional modules changed, but also the associated carded module into which that functional module plugs.

There follows a description of a modular construction of electronics or opto-electronics equipment embodying the invention in preferred forms.

- 20 The description refers to the accompanying drawings in which:-

Figures 1 and 2 depict schematic perspective views of alternative forms of the equipment.

- 25 Referring to Figure 1, a modular construction of electronics or opto-electronics equipment has a set of functional electronics and/or opto-electronics modules 10 (of which only one is specifically illustrated in Figure 1) that plug into a back-plane structure 11.

- 30 In the case of equipment that is an ONU, these different functions provided by the different modules 10 may for instance comprise those of a power supply, a central processor, an optical processor, POTS multi-line cards, ISDN multiline cards, Broadband multi-line cards, and optical amplifier and a passive optical splitter. In any such ONU there may be 35 more than one module of the same type. Typically, but not necessarily,

a single generic enclosure is employed as a housing for each of the different types of module 10.

- 5      Each functional module 10 has an upper and a lower plug-in port 12a, 12b. The upper plug-in port 12a is an interconnection port for providing interconnection between the modules via the back-plane structure. The lower plug-in port 12b is an input/output port for providing input/output connection to the module via a flexible lead connection, such as twisted pair, co-ax or optical fibre.
- 10     When the module 10 is plugged into the back-plane structure 11, the two connector ports 12a and 12b enter apertures 13a, 13b in the front surface of the back-plane structure. In this position, interconnection port 12a is operationally connected with a co-operating port (not shown) mounted within the back-plane structure on a board (not shown) that provides interconnection tracks between plugged-in modules 10. At the same time input/output port 12b is operatively connected with a co-operating port 14 provided on the end of an associated flexible lead termination module 15 that is engaged in the bottom of back-plane structure. Such a flexible lead termination module 15 may take one of a number of different forms according to the type of function being performed by the functional module 10 with which it is associated. It may simply serve to provide connection between its flexible lead(s) 16 and thus the port 12b of the functional module 10, or it may provide additional functionality. For instance a module 15 may incorporate a mains filter (not shown) in the case of a mains lead termination module 15 providing an input to a power supply functional module 10, or may incorporate electro-optic transducers (not shown) in the case of an optical fibres termination module 15 providing input/output to a high bandwidth functional module 10.

Figure 1 depicts two different kinds of module 15 providing different functions. Module 15a terminates a single flexible lead 16a which may for instance be constituted by a bundle of twisted pairs, a length of co-ax, or a length of mains lead. Module 15b terminates a pair of flexible leads 16b, typically an input lead and an output lead, which may for

instance be constituted by optical fibre cables. This module 15a is somewhat larger than module 15a in order to accommodate active components such as semiconductor lasers and photodiodes and associated circuitry, and in this instance is provided with cooling fins 17.

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Figure 2 depicts a similar ONU, differing from that of Figure 1 principally in the fact that it employs a modified form of back-plane structure 21. This back-plane structure 21 includes pivoted covers 22 each of which, in its closed position covers a pair of apertures 13a and 13b, sealing them in the absence of a plugged in module 10, and in its open position provides a mechanical support and/or guide for the module 10 plugged in to the apertures 13a and 13b thereby exposed. The design of the functional modules 10 is unchanged unless a keyway (not shown) is provided for engagement with a complementary profile (not shown) on the cover 22. The design of the flexible lead termination modules 25a and 25b differs from that of its counterparts 15a and 15b only in that the reach of portions 26a and 26b engaging in the back-plane structure 21 is extended to make allowance for the increased vertical dimension of the back-plane structure required to accommodate the pivoting covers 22.

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Preferably the ports 14 of the different type of module 15, 25 and the ports 12b of the different functional modules 10 are provided with a system of complementary keys and keyways (not shown) designed to preclude the mating of an inappropriate version (functionality) of module 15 or 25 with any particular version (functionality) of module 10.

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For illustrative convenience only, have the back-plane structures 11 and 21 been represented as each having the capacity for accepting four functional modules 10. Moreover the sides of the individual back-plane structures may be provided with interconnection ports to enable the capacity of an individual back-plane structure to be expanded by the plugging into one of its sides of an extension back-plane structure. Such an extension back-plane structure may be, but is not necessarily, identical with the back-plane structure into which that extension back-plane structure is plugged.

**CLAIMS:**

1. A modular construction of electronics or opto-electronics equipment having a set of functional electronics or opto-electronics modules that plug into a back-plane structure that provides interconnection between the modules plugged into the back-plane structure, wherein each functional module is provided with a plurality of plug-in ports for engagement with the back-plane structure, of which plurality one is dedicated to an input/output function and at least one other provides interconnection via the back-plane structure with one or more other functional modules plugged into the back-plane structure, wherein said one plug-in port dedicated to an input/output function plugs into an associated flexible lead termination module which is releasably engaged in the back-plane structure.
- 15 2. Modular equipment as claimed in claim 1, wherein the back-plane structure is provided with cover members that, in a closed position serve to cover ports in the back-plane structure into which the plug-in ports of the functional modules plug in, and that in an open position provide support for the functional modules when they are plugged into the back-plane structure.
- 20 3. A modular construction of electronics or opto-electronics equipment substantially as hereinbefore described with reference to the accompanying drawings.
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The  
Patent  
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Claims searched: 1 to 3

Examiner: F J Fee  
Date of search: 30 June 1995

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.N): H2E [ECAGT, ECHU, ECSH, ECSX], G2J [JGEA, JG17], H4B [BKJ]

Int Cl (Ed.6): G02B, H01R, H04B

Other:

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
A	GB 2253317 A [G.P.T.] fig. 4	
A	EP 0209822 A2 [A.T.T.] figs. 4,6	
A	WO 85/03179 A1 [HASE]	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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